

Excalibur Family of Artillery Projectiles

Excalibur is a family of precision-guided, extended-range modular projectiles incorporating three unique payload capabilities divided into Block configurations. Block I consists of high-explosive, fragmenting, or penetrating unitary munitions to enhance traditional fire support operations with increased range, improved accuracy, and reduced collateral damage against personnel, light materiel, and structure targets. Block II consists of smart munitions to search, detect, acquire, and engage fleeting and short-dwell targets common to open-terrain battlefields. Block III consists of discriminating munitions to selectively identify and engage individual vehicular targets in urban environments by distinguishing specific target characteristics. Excalibur's precision capabilities are intended to be used by Future Combat System (FCS) Non-Line-of-Sight (NLOS) Cannon units to provide close support to maneuver units in urban or complex terrain. Digitized lightweight 155mm howitzer systems will be used to develop and test Excalibur's capabilities before FCS NLOS Cannon is fielded.

The Excalibur development team combines U.S. guidance expertise with Swedish airframe experience. The projectile will employ Global Positioning System (GPS)-aided inertial guidance and navigation, free spinning base fins, four-axis canard airframe control, base bleed technology, and a trajectory glide to achieve increased accuracy and extended ranges beyond 30 km. The FCS NLOS Cannon will incorporate an inductive fuze setter to transfer target and fuze data to the integral fuze.

Excalibur system development began in 1997 with a dual-purpose improved conventional munitions variant, but shifted to the Unitary projectile in January 2001. In November 2001, the Army Acquisition Executive merged the Raytheon Excalibur (U.S.) and Bofors (Sweden) Trajectory Correctible Munition programs. In February 2002, Army leadership directed Excalibur to follow a block acquisition strategy. The Block I (Unitary) Milestone C is scheduled for FY06, and an initial operational capability (IOC) in FY08. For Block II (smart) and Block III (discriminating), Milestone Bs are scheduled in FY08, Milestone Cs in FY13, and IOCs in FY16.

TEST & EVALUATION ACTIVITY

DOT&E worked with the Excalibur Test and Evaluation Integrated Product Team (IPT) to develop a Block I Excalibur Test and Evaluation Master Plan, including a comprehensive LFT&E strategy that fully integrates lethality with developmental and operational test events. Test events thus far have been limited to component-level testing. In a March 2003 contractor firing, a functional guidance section acquired and tracked 11 GPS satellites and the control actuation system exercised flight control canards. LFT&E activities this year included preliminary developmental testing of the Unitary warhead.

TEST & EVALUATION ASSESSMENT

Key technical risks for the Unitary program include reliable fin deployment, airframe maneuverability, warhead fuze development, inertial measurement unit hardening, and GPS acquisition. In the last year, gun-hardening tests demonstrated integrated GPS acquisition and tracking and inertial measurement unit mechanical performance to 12,000g acceleration levels. The canard actuator system functioned after firing. Accuracy required for engaging area targets should be achievable, but achieving the greater accuracy required for structures and other point targets is higher risk.

Smart projectiles such as SADARM (U.S.), Smart155 (Germany), and Bonus (Sweden) that employ millimeter wave variants and infrared sensors to engage armored targets have shown success against benign targets, but are less successful against countermeasured targets. Germany and Sweden are working on product improvements that



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should make the technology more effective by the start of the Block II and III programs. Technology that discriminates between individual targets is unproven.

The testing for the XM982-Unitary munition described in the draft LFT&E strategy is fully integrated with planned developmental and operational testing, in order to efficiently use available test resources. There are no dedicated, full-up, system-level, LFT&E events. Realistic gun-fired lethality testing is planned during developmental test events using a live fire target array consisting of mixed personnel and light materiel targets, and threat representative structure targets of specified construction. Warhead technical testing, and some gun-fired testing, will be completed in time to support a Milestone C decision review.

Excalibur may be susceptible to GPS jamming. If GPS jammers are employed in the vicinity of the target, then the Army expects Excalibur to use its inertial navigation system to hit the target. However, if jamming prevents initial GPS acquisition, then the round will follow a ballistic trajectory instead of achieving guided flight and may endanger friendly forces in the area of the ballistic round's impact.

Excalibur will require accurate target location data in order to achieve desired effects for the Unitary variant. Target location errors will need to be 35 meters or less for personnel targets, and approximately 10 meters or less for targets requiring a direct hit.

Test and evaluation issues to be resolved during the Test and Evaluation Master Plan development include the selection of an adequate test site that can accommodate testing in a GPS-jammed environment at the extended range Excalibur offers, and identification of appropriate targets and quantity of fire missions for the IOT&E.